results, show that the centrosomes retain their individuality through every change. Couple with these facts the discovery by Dr. Field of the entry of the centrosomes into the spermatozoa of the echinoderms, and a quite similar state of things I have found to occur in mammals, and there seems much evidence that the centrosomes, unlike the other constituents of the sphere, retain their individuality during successive mitoses, and are incorporated as an essential constituent of the spermatozoa.

Further, the well-known observations of Fol, and more recently those of Fick, show clearly that these bodies assume their old functions as dominants of the attractive process in the initial steps of fertilisation. Their identity through successive generations being thus maintained, the

FIG. 4.

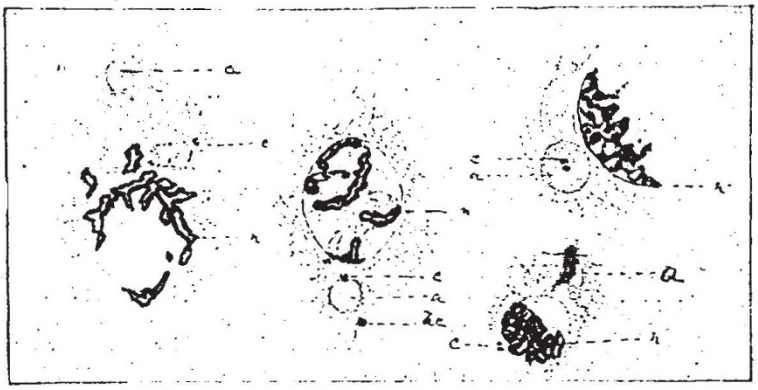

FIG. 1. FIG. 2. FIG. 3.

important functions they perform in the division process itself necessitates our regarding them, with Van Beneden, as organs of the cell, although, when viewed in such a light, they will have to be disrobed of their more conspicuous radial and archoplasmic vestments. With respect to these latter, in whatever degree they may be present, it seems an unavoidable conclusion that they can only be regarded as the effect produced by the inconstant action of polarity or whatever power is exercised by the centrosomes on the surrounding kytoplasm.

J. E. S. MOORE.

HERMANN VON HELMHOLTZ.

HONOURED and mourned by all, Prof. von Helmholtz, one of the most brilliant men who have devoted their lives to science, passed away at Charlottenburg, on Sunday last. Shortly before his death, the Empress Frederick sent a telegram of inquiry as to his condition, and upon hearing of his decease messages of sympathy were sent to the sorrowing relatives by the Emperor and herself. This fact is a significant indication of the regard in which the representatives of science are held in Germany.

Hermann Ludwig Ferdinand Helmholtz was born August 31, 1821, at Potsdam, where his father, Ferdinand Helmholtz, was Professor in the Gymnasium, his mother, Caroline Penn, being of an English family. While but a schoolboy he developed a love for science, and studied all the books on physics which his father's library contained. They were very old-fashioned; phlogiston still held sway, and electricity had not grown beyond the voltaic pile. When the class was reading Cicero or Virgil, he was finding the paths of the rays in a telescope, or developing optical theorems not usually met with in text-books. At that time there was little possibility of making a living out of physics, so, acting on the advice of his father, Helmholtz took up the study of medicine. He entered the Army Medical School, the Friedrich Wilhelms Institut, and while there came under the influence of a profound teacher—Johannes Müller. He eventually became a military surgeon, and continued in that position till the end of 1848, when he was appointed Assistant of the Anatomical Museum of Berlin, and Teacher of Anatomy at the Academy of Arts.

In 1847, that is, during his career as an army surgeon, Helmholtz's essay, "Ueber die Erhaltung der Kraft," was published. In this, the principle of the conservation of energy was developed. About Joule's researches on the same subject, he knew at that time but little, and nothing at all of those of Robert Mayer. He was led to write the essay by an examination of Stahl's theory, adopted by most physiologists, which accorded to every living body the nature of a *perpetuum mobile*. The essay contained the results of a critical investigation of the question whether any relations existed between the various kinds of natural forces for perpetual motion to be possible. It was written for the benefit of physiologists, but, to Helmholtz's surprise, the physicists took up the doctrine of the conservation of energy, which some of these were inclined to treat as a fantastic speculation. Jacobi, the mathematician, recognised the connection between the line of thought in the essay, and the principles investigated by Daniell, Bernouilli, d'Alembert, and other mathematicians of last century, and soon the members of the then young Physical Society of Berlin accepted Helmholtz's results. It is unnecessary for us to dwell upon the marvellous influence that these results have had upon physical science during the last half-century. The principle of the conservation of energy has long passed through the debatable stage, and some of the greatest discoveries in thermodynamics and other branches of modern physics have been deduced from it.

In 1849 Helmholtz went to Königsberg as a Professor of General Pathology and Physiology; seven years later he accepted a similar position at Bonn University. While at the former University he designed the ophthalmoscope for the diagnosis of diseases of the inner parts of the eye—a discovery which shows the great importance to the physiologist and physician of a thorough knowledge of physical principles. The year 1859 saw him occupying the chair of Anatomy and Physiology at Heidelberg; and in 1871 he was appointed Professor of Natural Philosophy in the University of Berlin, a post which he held until his death.

The two great works of Helmholtz on "Physiological Optics" and on the "Sensations of Tone," are splendid examples of the application of methods of analysis to the two kinds of sensation which furnish the largest proportion of the raw material for thought. In the first of these works, the colour-sensation is investigated, and shown to depend upon three variables or elementary sensations. The study of the eye and vision is made to illustrate the conditions of sensation and voluntary motion. In the work on the "Sensation of Tone as a Physiological Basis for the Theory of Music," the conditions under which our senses are trained are illustrated in a yet clearer manner. His researches threw a flood of light upon what may be termed the mechanical, physical, physiological, and psychological processes involved in seeing and hearing.

No good end would be served by enumerating Helmholtz's contributions to knowledge. The versatility of his genius is well known among all workers in the realm of nature. Mathematics, physics, physiology, and psychology are but a few of the branches of knowledge which have been enriched by his investigations. His acquaintance with science was not only extensive but

thorough, and, as Clerk Maxwell said in these columns in 1877 (vol. xv. p. 389), the thoroughness was that which of itself demands the mastery of many sciences, and in doing so makes its mark on each. He solved problems with which great mathematicians, since the time of Euler, had occupied themselves in vain. Questions as to vortex motion and the discontinuity of motion in liquids, and the vibrations of sound at the open ends of organ pipes, belong to this class of subjects elucidated by him. In his numerous papers on thermodynamics, he reduced to an intelligible and systematic form the labours and intricate investigations of several independent theorists, so as to compare them with each other and with experiment. Other subjects investigated by him are electrodynamics, stereoscopic vision, galvanic polarisation, the theory of anomalous dispersion, the origin and meaning of geometrical axioms, the mechanical conditions governing the movements of the atmosphere, the production of waves, &c. But even the circle of natural and physical sciences does not embrace all the subjects which he benefited by his keen insight and strenuous energy. He was an acute logician and an accomplished metaphysician. His investigations on perception and observation of the senses led him to study the theory of cognition. The principal conclusion he came to after an examination of the subject, was that the impressions of the senses are only signs for the constitution of the external world, the interpretation of which must be learned by experience.

In 1891, when Helmholtz reached his seventieth birthday, the event was made the occasion of an international celebration. In honour of the anniversary, a marble bust was prepared, and numerous marks of respect were bestowed upon him by his admirers, both in and out of his own country. The German Emperor raised him to the highest rank in the Civil Service; the Kings of Sweden and of Italy, the Grand Duke of Baden, and the President of the French Republic conferred Grand Crosses upon him; many academies, not only of science, but also of the fine arts, faculties, and learned societies representing all parts of the world, sent him diplomas and richly illuminated addresses, expressing their recognition of his scientific labours, and their thanks for his work. His native town, Potsdam, conferred its freedom upon him, and countless individuals sent their congratulations. It was on the occasion of this jubilee that Helmholtz delivered the autobiographical sketch published in the second volume of his "Scientific Lectures," and which has furnished us with some of the particulars contained in the foregoing. He was made a Foreign Member of the Royal Society in 1860, and received the Copley Medal in 1873. He was also one of the Associés Etrangers of the Paris Academy of Sciences, and a correspondent of most important scientific academies and societies all over the world.

Science has had few investigators who have furthered her interests more than Helmholtz. He was constantly exploring new fields of research, or bringing his keen intellect to bear upon old ones. With his contributions he helped to raise science to a higher level. And, while he did as much as anyone to render scientific discoveries understandable to the whole intellectual world, he always recognised that he was in the service of something that should be held everlastingly sacred, a feeling which kept him from playing to the gallery either in his popular works or in his lectures. Many years ago, it was written—

"A wise man instructeth his people, and the fruits of his understanding fail not."

"A wise man shall inherit glory among his people, and his name shall be perpetual."

To no one could these words be more appropriately applied than to the eminent investigator whose loss we now deplore.

NOTES.

WE note with deep regret that Prof. H. K. Brugsch, the distinguished philologist and Egyptologist, died on Sunday last, at the age of sixty-seven.

THE Deputy-Mastership of the Mint, vacated by the resignation of Sir C. Fremantle, K.C.B., will be filled at once by the appointment of a distinguished official, Mr. Horace Seymour, Deputy-Chairman of the Board of Customs. If the post had been destined for a scientific man, it would doubtless have been given to Prof. Roberts-Austen, C.B., but his acceptance of it would have involved his resignation of his chair at the Royal College of Science. The due discharge of the duties of the Deputy-Mastership would, moreover, have left him far less opportunity for research than he has in his present office at the Mint, which he has made such an important one for science. Sir Charles Fremantle has always encouraged original research in his Department, and we wish him much happiness in his well-earned retirement.

THE death of the Comte de Paris recalls the fact that he was a Fellow of the Royal Society. He was elected by ballot on April 27, 1865, and signed the charter book on May 18 of the same year. Under the statutes which were then in force, any foreign sovereign prince or the son of a sovereign prince could be proposed for immediate ballot if he wished to enter the Society. In the case of the Comte de Paris it was found that, according to the strict letter of the statutes, the head and representative of a Royal house might be inadmissible by privileged election, whilst members of the same family of inferior rank were entitled to it. Although he was the hereditary representative of the then late King of the French, yet inasmuch as his father had not been a "sovereign prince," the Society was precluded from extending the courtesy of election, and therefore took steps to amend the statute, and upon being advised that Court usage would accord, introduced words establishing the privilege to "any foreign prince who is received by her Majesty as Imperial Highness, or Royal Highness." It was under such an amended statute that the unanimous election of the Comte de Paris occurred.

THE death of Prof. Josiah Parsons Cooke, LL.D., which took place in Boston, Massachusetts, on Tuesday, is, says the *Times*, not simply a loss to Harvard University, where he has laboured for more than forty-four years, but to the scientific world at large. His work on "The New Chemistry" is well known and highly esteemed, and has been translated into nearly every language of Europe. Born in 1827, he graduated from Harvard in 1848. In the following year he became tutor in mathematics, afterwards instructor in chemistry, and in 1850 Erving Professor of Chemistry and Mineralogy at Harvard. Under his direction the course in chemistry was greatly developed. He was the first in America to introduce laboratory instruction into the undergraduate course. In addition to his duties at Harvard, it was his practice to give courses of popular lectures on chemistry in the cities of Baltimore, Brooklyn, Washington, Lowell, and Worcester, besides his regular lectures at the Lowell Institute in Boston. As director of the chemical laboratory at Harvard he has published numerous contributions to chemical science, most of which have been collected and published in a volume entitled "Chemical and Physical Researches." In 1872 he was elected an honorary Fellow of the Chemical Society, sharing that distinction with only one other American; and in 1882 he was granted the degree of LL.D. by Cambridge University.

THE death is announced of Sir Edward Augustus Inglefield, K.C.B., F.R.S., at the age of seventy-four. The following particulars as to his scientific work are extracted from an